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Phenomenon.	Local Sidereal Time. h m s	Local Mean Solar Time. h m s
First contact with ring	11 11 10·4	8 6 40·6
Total disappearance of ring	11 11 55·9	8 7 25·9
Disappearance of Satellite I.	11 14 34·4	8 10 4·0
,, Satellite II.	11 15 52·9	8 11 22·3
First reappearance of ball	12 9 55·4	9 5 15·9
Last contact with ball	12 10 27·4	9 5 47·8
Last contact with ring	12 10 54·4	9 6 14·8

On the Successive Illuminations of the Lunar Crater Geminus.
By W. R. Birt, Esq.

A few years since a Committee of the British Association for the Advancement of Science was appointed to examine into the physical character of the moon's surface. Among the suggestions and recommendations offered by the Committee is that of the examination of any particular part of the lunar disk under at least three aspects, viz., a morning or forenoon, a midday, and an evening illumination. Having lately directed my attention to the crater *Geminus*, and observed it during *two* lunations under the three aspects recommended, I have been so struck with a somewhat remarkable feature that has presented itself in the midday illumination, that in the hope of a more powerful examination being made of it than I am able to effect, I am induced at once to lay the details before the Society rather than wait for fuller details resulting from any future observations I may make, which delay may possibly occasion an omission of a notice of it entirely.

The crater is situated in the north-west quadrant of the moon *as seen from the earth*, and northward of the *Mare Crisium*. It has to the westward of it a smaller crater named *Bernouilli*. Under a morning illumination it presents an elliptical outline, the western wall being in shadow, the eastern being more or less strongly illuminated by the sun's rays according to their obliquity. A bright spot exists between it and *Bernouilli*. The floor of the crater *Bernouilli* is very much darker than that of *Geminus* at a period of the lunar day corresponding to 7 days of the moon's age, while the space between *Geminus* and *Bernouilli* presents about the same reflective power as the floor of *Geminus*. A dark space of the same intensity as the floor of *Bernouilli* extends northward of this crater. These features are exhibited on the drawing* representing the forenoon illumination on May 9, 1859, between 8 and 10 hours, G.M.T., at 9 P.M. of that day the moon's age was 6·96 days.

Three days afterwards, viz. on May 12, between 7·30 and

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* This drawing and the other, to which he refers were exhibited at the meeting.

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12·30 P.M., moon's age at 10 P.M. equal 10·00 days. The remarkable feature which forms the subject of this communication was fully brought out. In the drawing illustrative of this feature the crater *Burckhardt* between *Geminus* and *Cleomedes* is introduced. Only a portion of the outline of *Geminus* at this period of the moon's age and under the angle of a midday illumination is discernible: the southern part of the crater appears to be cut off by a dusky patch extending from about the centre to a forked rillen emanating from the bright spot between *Geminus* and *Bernouilli* and branching towards *Burckhardt.* This dusky patch is not confined to *Geminus,* but extends to the westward of it nearly to the dark space northward of *Bernouilli,* while on the north of the nearly straight line bounding it a much lighter space is seen in which the outline of the northern part of the crater is very perceptible. The partial obliteration of the outline of the crater by a darker space, as if something had covered it, and the persistency of the remaining part in a lucid space apparently connected with a bright streak of the same character as those emanating from the bright crater *Proclus,* are phenomena in themselves sufficiently interesting to induce a closer observation of them, with the view of ascertaining if they are connected with any physical peculiarity of this part of the lunar surface.

Under the evening illumination these peculiar features disappear, the outline of *Geminus* is again complete, *Burckhardt* and *Bernouilli* exhibit striking contrasts of light and shadow, the rillen observable at midday are no longer to be seen, although the spots with which they appear to be connected are mostly recogniseable; the only features that appear to be common to the three aspects is the dark space northward of *Bernouilli,* a small rillen north of the crater is seen in the midday illumination, with this exception this feature is the most persistent.

The drawing representing the evening illumination is for the epoch April 18, 1859, between 12 and 16 hours G.M.T., 41 hours after full moon, the moon's age being 15·7 days. The evening illumination during the May lunation was not visible on account of clouds.

Desiderata.—The three views suggest various desiderata. It would appear from an inspection which I made of *Geminus* on the evening of Tuesday the 10th of May, about 24 hours after the epoch of the drawing representing the forenoon illumination, that the crater underwent a kind of *transition* from the elliptical form seen on May 9 to the partially obliterated outline seen on May 12. In my note of May 10, 9^h, I have the following remarks:

"*Geminus.*—The outline of this crater *distinct,* a part of the floor southwards appears to be *darker* than on last evening, but not of that character as observed at a later period last moon; the internal northern wall very bright; the darker part of the crater appears as if somewhat *terraced,* it is clearly

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approaching the appearance it presented at a later period last moon."

It would be important to ascertain by *observation* the exact age of the moon, or still better the time elapsed from the initial illumination of the crater to the completion of the obliteration (between 8 and 10 days of the moon's age), also the phenomena of the *transition* from the perfect to the imperfect outline of the crater, with the various epochs of the visibility of the rillen; and in addition, as the sun declines on *Geminus*, the epochs of the re-completion of the outline and the commencement of the evening shadows.

APPENDIX.

As the peculiar feature alluded to in the foregoing paper appears to be connected with the system of luminous rays or streaks emanating from the bright crater *Proclus*, I have appended an ephemeris of *their* phenomena as well as some appertaining to *Geminus* and *Bernouilli* for the lunations in July and August next, extracted from a much more extensive one constructed for my private use.

July 5, 10·0 ☽'s age 5·31 Aug. 3, 10·0 ☽'s age 5·02	One of the luminous streaks from *Proclus* over the *Mare Crisium*, between the craters A and B (Beer and Madler's map) very faintly perceptible. *Geminus* and *Bernouilli* perfectly free from streaks or the appearance of rillen.
July 6, 10·0 ☽'s age 6·31 Aug. 4, 10·0 ☽'s age 6·02	Three luminous streaks of a somewhat forked character radiating from *Proclus* over the *Mare Crisium*. *Geminus* and *Bernouilli* perfectly free.
July 7, 10·0 ☽'s age 7·31 Aug. 5, 10·0 ☽'s age 7·02	The three streaks over *Mare Crisium* from *Proclus* more strongly marked. The streak skirting the north-west border of the *Palus Somnii* beginning to be apparent.
July 7, 10·0 ☽'s age 7·31 Aug. 5, 10·0 ☽'s age 7·02	About these ages of the moon an occasional gleaming of the rays from *Proclus* to the crater A (?), and towards *Geminus* may be detected also a bright luminosity about the crater A; this crater is considerably to the eastward of *Geminus* and north-east of *Cleomedes*. *Geminus.*—Perfectly free from luminous streaks, outline elliptical, *western wall* in shadow, with a somewhat dark spur extending a little *inwards*. *Eastern wall*, the south-

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east portion not so dark as the north-eastern, the north-west wall brightest.*

Bernouilli perfectly free from luminous streaks.

July 8, 10·0
☽'s age 8·31
Aug. 6, 10·0
☽'s age 8·02

The bright streak from A towards *Geminus*, which appears to be connected with the separation of the crater *Geminus* into a luminous and dusky portion, is discernible about these ages.

July 9, 10·0
☽'s age 9·31
Aug. 7, 10·0
☽'s age 9·02

Geminus separated into two portions; a dusky and lucid outline of the northern portion distinct, a well-marked dark spur projecting outwards from the north-west part of the outline margin of the crater, edged with a somewhat dark fringe.

Bernouilli.—Floor very much darker than that of *Geminus*, north-eastern part of the margin of the crater bright.

July 9, 10·0
☽'s age 9·31
Aug. 7, 10·0
☽'s age 9·02

Rillen.—Several rillen, or narrow light streaks, become discernible in the neighbourhood of *Geminus*, at or about these ages of the moon:—

First.—A light streak eastward of *Geminus* to the north-eastern border of the crater, near the dark spot on its eastern margin.

Second.—A forked rillen from the eastern border of *Geminus;* only a portion of this rillen is discernible at these ages, it is directed towards the spot whence emanate the first rillen noticed above. The branches are well seen a day later.

Third.—A forked rillen, emanating from the bright spot between *Geminus* and *Bernouilli*, one branch is directed towards *Burckhardt*, the other, which is fainter, towards the forked rillen (second).

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* Between these epochs 7·31 and 8·31 of the moon's age one main feature apparently connected with the separation of the crater into two portions, comes into view; it is a rillen crossing the crater transversely and apparently connected with the rillen (second) of the list noticed under date July 9, 10·0. The continuity of the rillen appears to be interrupted by the dark fringe on the eastern margin of *Geminus*, and the rillen itself, within the crater, forms the southern border of the luminous portion of the crater when separated into two.

I observed this rillen very distinctly on the evening of June 8, 1859, between the hours of 9 and 10, moon's age about 7·60, the southern part of the crater was then very little, if at all, inferior in brightness to the northern.

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Fourth.—A well-marked curved rillen from the spots northward of *Bernouilli.*

Fifth.—A straight rillen from *Bernouilli* northward.

N.B. This ephemeris will be available for any subsequent lunations by just altering the dates to suit the ages of the moon in September and following months, and by careful observation the times of the first appearance of the rillen and other features may be detected.

Description of Various Processes made use of for Finding out the Configuration of Optical Surfaces. By M. Leon Foucault.

(*Communicated by Mr. De La Rue.*)

"One of the principal advantages of the reflecting telescope consists in having, instead of an object-glass, a mirror which acts by means of a single surface; which surface being concave lends itself with remarkable facility to the application of the processes of examination which permit the appreciation of its figure even to the least details.

"I conjointly make use of three different processes. The first consists in placing very near to the centre of curvature a very small object, such as the point of a pin, in order to obtain an image of the same size as, and very near to the object itself; this image can then be observed by means of a microscope and compared directly with the object. We are thus enabled to judge with certainty by means of the amount of definition, of the effect which the mirror mounted as a telescope will give.

"If the image is imperfect, it is better then, with the view of ascertaining the faults of figure, to take a luminous point and observe the appearance of the pencil of light within and without the focus. It will be seen to decompose itself in partial images, the discussion of which gives at once some information respecting the configuration of the surface of the mirror.

"But the two processes I am about to point out are still preferable and give this information with greater precision.

"An object having parallel sides, such as the edge of a thin piece of steel, having one millimètre ($0^{\text{in}}\cdot03937$) in thickness is placed in the neighbourhood of the centre of curvature, and in order that the object may project itself in outline it is enlightened from the side opposite to the mirror, and the image which is formed by it, being on a luminous ground, becomes very apparent, and presents in its aspect some peculiarities which depend upon the figure of the mirror. This image being observed with the naked eye at the distance of distinct vision is seen in each of its parts, but, by means of rays passing through the